

# Solar Photovoltaics



**RENEWABLE  
ENERGY  
PROGRAM**

CALIFORNIA ENERGY COMMISSION

**S**olar energy is a renewable resource that is inexhaustible and readily available, unlike fossil fuels such as coal, oil and natural gas. Fossil fuels were formed over millions of years from carbon-based material found in plants and animals. They need to be found, extracted from the earth and then processed for use. When fossil fuels are burned, they release pollutants into the air that are very harmful to humans and the environment. On the other hand, solar electricity is a free source of fuel that is clean and can be used to make more environmentally-friendly electricity. Electricity can be produced from sunlight through a process called photovoltaics (PVs), which literally means light energy.

Photovoltaics is a high-technology method of using the photons within sunlight to generate electricity. PV cells are made of at least two layers of semiconductor material. One layer has a positive charge, the other a negative charge. When sunlight enters the cell, some of the photons from the light are absorbed by the semiconductor atoms, freeing electrons from the cell's negative layer to flow through a circuit and back into the positive layer, producing an electric current. Dozens of individual cells can be arranged together in a sealed, weatherproof package to form a module to produce more energy. Modules can then be fitted into an array, which produces electricity based on the number and efficiency of the modules. The flexibility of the modular PV system allows designers to create solar power systems that can meet a wide variety of electrical needs, large or small.

PV cells have been used for many years, first to power satellites and then to power more common items that require small amounts of electricity such as calculators, watches, water pumps and emergency call boxes. As the cost to produce PV cells has decreased and their

conversion from light-to-electricity efficiency has increased, they are being used today to provide electricity directly to businesses, schools, homes and boats.

Over two billion people in the world today live without electricity from transmission lines. Most of these people get electricity from diesel generators that are unreliable, noisy, cause air pollution and use a toxic fuel that must be transported to them. In most cases where there is no utility electricity available, it is because power transmission lines are too expensive to build and extend to their location. PVs provide a clean, reliable, cost-effective solution. In parts of the world where electricity is plentiful, businesses, schools and homes are installing PVs

to offset the cost of electricity or provide reliable electricity at peak-use times as well as help the environment. These applications range from stand-alone PV arrays to roof-integrated PV panels. In addition, large arrays of PVs are built and maintained by power companies to provide significant amounts of electricity to the power grid.



*The Ferris wheel at the Santa Monica Pier is powered by the PV panel located on top of the blue shed. Funding was provided by the California Energy Commission's Public Interest Energy Research Program (PIER).*

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For more information, contact the California Energy Commission Call Center at **1-800-555-7794** or visit our Web Site at:

**[www.energy.ca.gov/renewables](http://www.energy.ca.gov/renewables)**